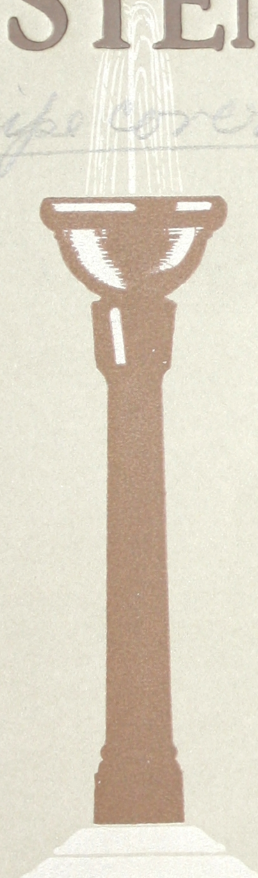
DRINKING WATER SYSTEMS



Cork pipe covering

NONPAREIL
CORK COVERING

for Drinking Water Systems in Mills
Factories, Hotels, Office Buildings
Hospitals, Public Buildings, etc.

Nonpareil
Reg. U. S. Pat. Off.

Armstrong Cork & Insulation Company
Pittsburgh, Pa., U. S. A.

Branches in the Principal Cities of the United States and Canada

Public Fountain Installed by the National Tube Co., as a Part of the Drinking Water System at its Continental Works, Pittsburgh, Pa.
1170 People Drank From It in One Day

Drinking Water Systems

LEGISLATIVE enactments, and a growing appreciation of the physical and economic advantages of furnishing a bountiful supply of pure water to workers in all lines of industry, have made the drinking water problem a live issue in almost every industrial establishment. The old bucket-and-dipper method is not only unsanitary, expensive and wasteful of time, but has proven positively injurious on account of the temptation to drink excessive quantities at the infrequent opportunities it affords. Particularly in mills, foundries and smelters, cases of cramps have been frequent and apparently unavoidable. The lack of an adequate supply of water is, moreover, manifested in a general tendency toward lowered efficiency and decreased production.

A Live Question

Requirements for an Ideal System

Analysis reveals that an ideal drinking water system should embody the following essential requirements:

1. The water should be attractive in appearance, clear and sparkling—not discolored or malodorous. Otherwise, the prime object—encouraging the workmen to drink in sufficient quantities—will be defeated.

Pure Water

2. The water supply should not only be wholesome, but known to be wholesome. The necessity of this is self-apparent. Typhoid, dysentery, and other diseases are directly traceable to polluted water supply, and if the water is not known to be pure and healthful, there will be an inevitable disinclination to drink it.

Known to be Pure

From Sanitary Fountains

3. Common drinking vessels should be eliminated. The most feasible way is to substitute fountains. Bacteria are always present on the lips and in the mouths of all human beings and medical research has demonstrated that many serious diseases are transmitted through the use of common drinking vessels.

Properly Cooled Water

4. The temperature of the water should be carefully regulated. Otherwise, physical injury may ensue. Lukewarm water is not palatable and is not apt to be drunk in sufficient quantities. On the other hand, water that is too cold, if taken in excess, produces cramps and thereby reduces the efficiency of the working force. Experience has proven that water from 45° to 50° F. is the most acceptable from every standpoint. It acts as a mild heart stimulant and also, to some extent, reduces the internal temperature of the body.

At Most Convenient Points

5. The drinking places should be close to the workmen. It is obvious that the further the operatives have to walk to get water, the more time they will lose from their tasks. An ideal system should, therefore, reduce loss of time to a minimum.

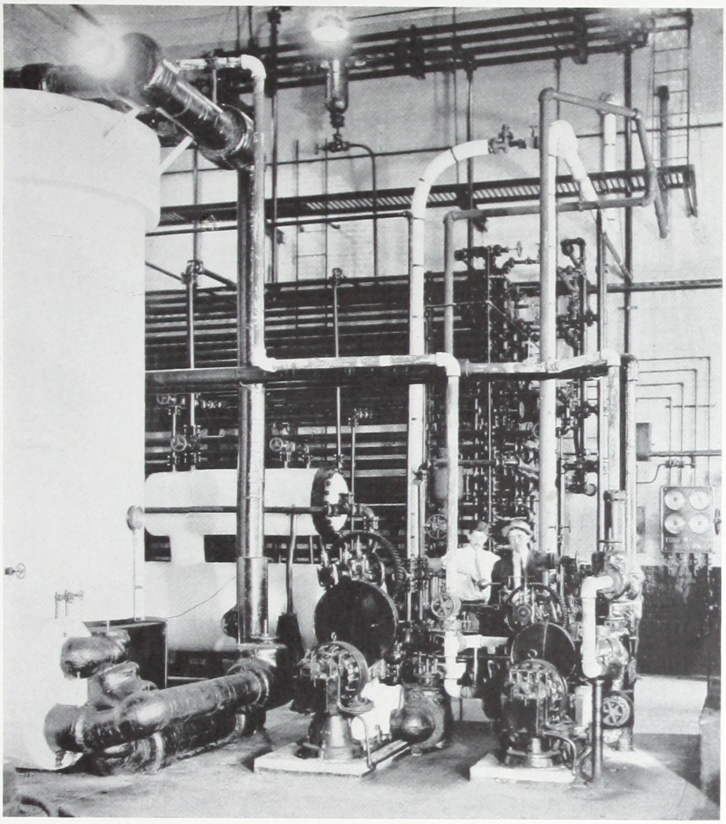
At Reasonable Cost

6. Whatever method is adopted must be reasonable in cost, taking into consideration, not only the initial investment but the expense of operation.

Various Methods

Many Plans Tried

Various plans have been tried: Buckets of water carried from one point to another, stationary coolers, pipe lines without artificial cooling; more recently, sanitary drinking fountains with the water supply cooled by separate ice boxes, maintained in conjunction with each fountain. All of these methods, however, fail in one or more respects to meet the requirements above set forth. Accordingly, plant owners and superintendents have been compelled to look further for the solution of the problem.



Nonpareil Cork Covering on Water Coolers and Connecting Lines
Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa.

The Ideal System

The One Satisfactory Method

In a number of instances, the problem has been solved with remarkable success by the installation of a small refrigerating plant, water cooling tank, insulated distributing lines—with drinking fountains located at convenient points—at a total outlay of less than the operating cost for two years with the old bucket-and-dipper method.

A Concrete Illustration

A Pittsburgh Steel Plant

A steel mill in the Pittsburgh District had been furnishing drinking water in this manner to approximately 1000 men at an annual cost of $5,000.00. In addition to the financial burden, the Company suffered from the sickness, loss of time and reduced efficiency of the workmen, resulting from drinking water of improper temperature.

$1.82 versus $5.00 per Employee per Year

By installing a refrigerated drinking water system at a total expense of less than $9,000.00 a permanent method of distribution was secured at a much lower operating cost. The only labor necessary to maintain its operation is that of the engineer in the power house, who looks after the refrigerating machinery and pump in connection with his other duties. The only expense (except for the water, which must be purchased from the city in any case) has been the replenishing of the ammonia for the refrigerating machine once a year at a cost of from $25.00 to $30.00, a small amount of oil, etc. The total operating cost when the mill is working full time, including the water, is about $1.82 per employee per year, as against approximately $5.00 per man by the old method.

Increased Efficiency

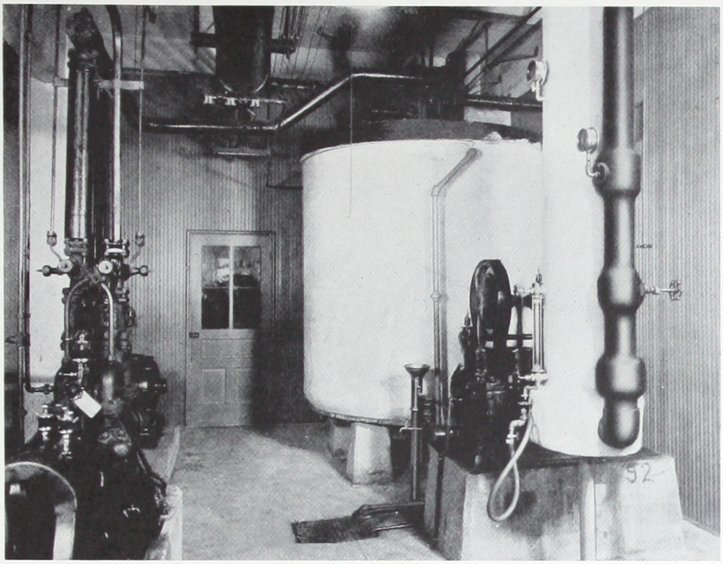
Besides the marked saving, a material benefit was derived through the increased efficiency and satisfaction of employees and reduction in time lost from productive work. Cases of cramps were reduced to an almost negligible number.

The Installation of Refrigerated Drinking Water Systems

The Salient Questions

In designing and installing systems of this character a number of questions at once present themselves, viz:

(*a*) What is the amount of water required per man per hour—including waste?



Brine Lines, Cooling Tank and Ice Water Piping Covered with Nonpareil Cork
The Lunkenheimer Company, Cincinnati, Ohio

(*b*) How should the pipe line circuits be arranged?

(*c*) What is the permissible temperature rise in the water circulating through the system?

(*d*) What is the maximum velocity permissible on these circuits?

(*e*) How much refrigeration is required?

(*f*) How should the apparatus be arranged?

(*g*) What kind of insulation is best and what thickness is required for pipe lines of this character?

From Observations and Tests

These questions will now be taken up in order. The data which follow have been secured through observation of actual installations and from a series of tests carried out in the testing station maintained by this Company at its plant at Beaver Falls, Pa.

(*a*) *What is the amount of water required per man per hour—including waste?*

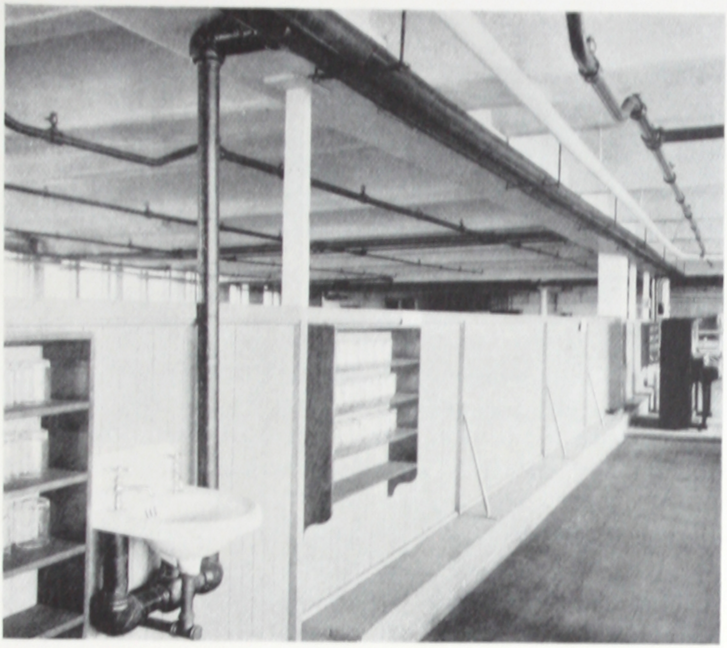
The amount of water which must be allowed for each operative varies, of course, in different industries and according to climatic conditions. In steel plants, where working conditions are severe, it has been found that, in summer weather, from .23 to .3 of a gallon is necessary per man per hour—including necessary waste. Naturally, in designing a system, provision must be made to take care of the requirements in the hottest weather. In other industries where there are not such great demands upon the physical strength of the employees and in factories employing female labor, the amount required will, of course, be somewhat less. For general purposes, the engineer will be safe in taking .25 gallons of water per operative per hour (including waste) as a basis.

¼ Gallon per Hour per Man

(*b*) *How should the pipe line circuits be arranged?*

The arrangement of the pipe line circuits depends entirely on the character of the plant, the grouping of the working force, the location of the power house, etc. Generally speaking, it is advisable to provide a supply main with two or more short branch circuits rather than a single exceedingly long one. In some plants successful installations have been made with circuits as long as 5,000 feet, but it is better practice to keep the branch circuits within 1,500 or 2,000 feet if possible. It is always wise to use one-inch pipe, but in cases where a considerable number of men must be provided for on a single circuit, larger lines can be employed to advantage. As conditions are never the same in any two plants, the engineer who is confronted with the problem of designing a system of this character will find the concrete example worked out on pages 34-37 of this book especially instructive.

Short Circuits Preferable



Drinking Water Lines Insulated with Nonpareil Cork Covering
John B. Stetson Company, Philadelphia, Pa.

(*c*) *What is the permissible temperature rise in the water circulating through the system?*

As experience has shown that water at from 45° to 50° F. is the most acceptable, the ideal system will be so designed as to provide for a temperature rise of not more than 5° F., with the water leaving the cooling tank at 45°. Not only will this be found to be economical from the standpoint of operation, but it will also insure the delivery of water of approximately the same temperature at all points in the plant.

Not More than 5° F.

(*d*) *What is the maximum velocity permissible in the circuits?*

As for the maximum velocity permissible in circulating the water in systems of this kind, there is room for considerable difference of opinion. Extended obser-

General View of Plant of Aluminum Company of America, New Kensington, Pa. The Drinking Water System is Insulated Throughout with Nonpareil Cork Covering

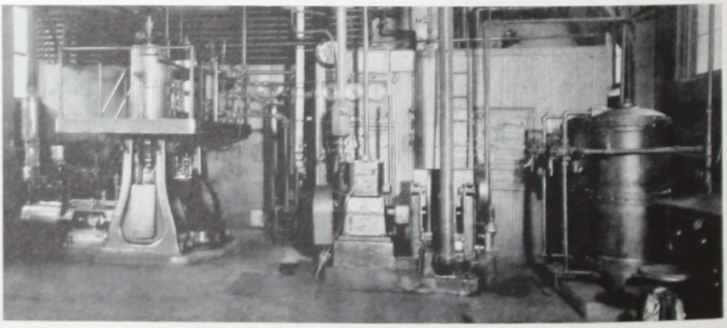
Not More than 190 Feet per Minute

vations of installations in regular operation indicate, however, that the velocity should not exceed 190 feet per minute if the best results are to be obtained. No matter how carefully water is filtered, a slight amount of sediment may appear in the course of time, and higher velocities would tend to stir it up and thus give the water a turbid appearance. By designing the system so as to obviate the necessity for high velocities, this condition is avoided.

(*e*) *How much refrigeration is required?*

Varies in Each Plant

The amount of refrigeration will depend, of course, on the size of the installation, the length of the distributing lines, the outside temperature, the temperature at which it is desired to maintain the water, the length



Ten-Ton Refrigerating Plant at Continental Works of National Tube Company, Pittsburgh, Pa. The Distributing Lines are Insulated Throughout with Nonpareil Cork Covering

of the working day, the manner in which the lines are insulated, etc. It will vary from .00027 to .0005 tons of refrigeration per hour per man. For the method employed in determining the amount necessary in any given case, see the concrete example on pages 34-37.

(*f*) *How should the apparatus be arranged?*

The Cooling Apparatus

The arrangement of the apparatus will also vary in the case of each installation. The diagram on this page (Fig. 1) indicates the general layout of a typical system of this kind. The water from the supply main passes first through a suitable filter—unless examination reveals that it is so pure chemically and so free

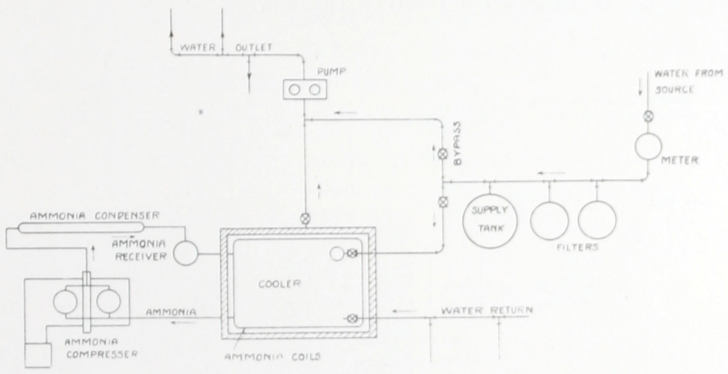


Fig. 1

from bacteria, that filtration is unnecessary. From the filter, it is admitted to the cooling tank, where a constant level is maintained by a suitable float valve. Here it is cooled by means of a refrigerating machine. The water is then forced by a small pump through the distributing lines. At the return end of each circuit, a thermometer is inserted in the pipe together with a gate valve, in order that the flow of water can be regulated so as to give an even temperature in every circuit.

The Distributing Lines

The distributing lines should consist of galvanized pipe. Long sweep fittings should be used, wherever possible, in order to reduce friction to a minimum. All lines should be carried overhead and not placed underground. This provides by far the more flexible system, renders the detection of leaks an easy matter and, through preserving the insulation on the pipes in better condition, materially reduces the cost of upkeep. The lines should be carefully arranged so that there will be no dead-ends; that is, the circuits should in all cases be carried past the fountains or spigots, so that the water will run cold immediately on opening the valves. The method by which this can be accomplished is indicated clearly on Fig. 2.

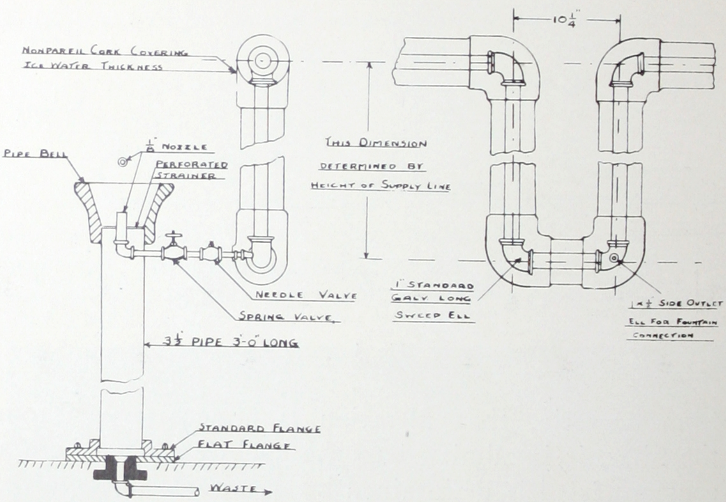


Fig. 2

The Drinking Fountains

Any desired type of drinking fountain can be employed. An inexpensive form is shown in Fig. 2. This consists of a 3½-inch steel pipe with a white-enameled bell holding the nozzle, which is set so low that the lips cannot touch it. The waste water flows

down through the inside of the 3½-inch pipe to the sewer. Of course, all fountains should be located at the most convenient points, as close to the workmen as possible, but not near dangerous machinery.

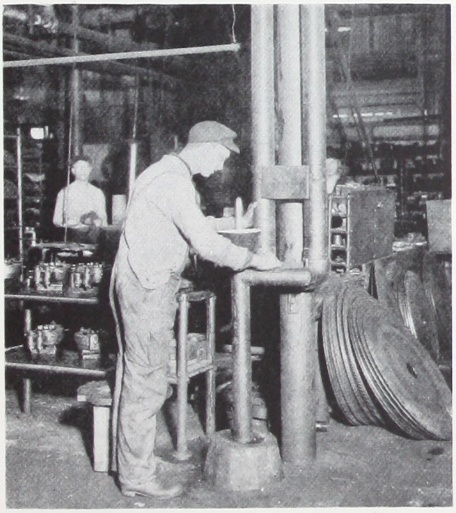
(g) *What kind of insulation is best and what thickness is required for pipe lines of this character?*

More than upon any other single item, the success of a circulating drinking water system hinges upon the insulation of the cooling tank and distributing lines. If they are not suitably protected from the heat, the water will rise rapidly in temperature, an undue amount of refrigeration will be required and the lines will sweat, causing the covering to disintegrate and soon rusting out the pipes. Too much attention, therefore, can hardly be paid to the question of securing insulation of the proper character and thickness.

Insulation the Most Important Point

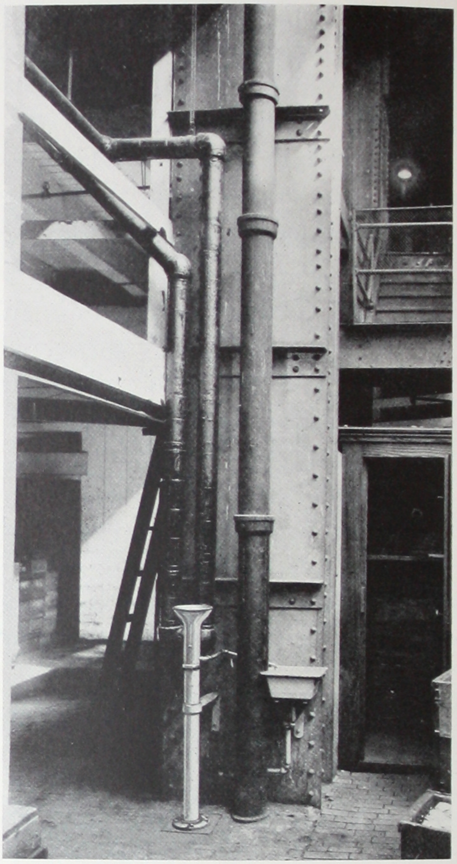
After extensive tests to determine the relative value of the various forms of cold pipe covering, one of the large steel companies some years ago decided to use Nonpareil Cork Covering—Ice Water thickness, for their drinking water lines. In this they have been followed by almost all the concerns that have since installed systems of this kind. According to the report of their engineers: "The great points in its (Nonpareil Cork

The Covering Most Concerns Have Used



Nonpareil Cork Covering on Drinking Water Lines
National Tube Company, Pittsburgh, Pa.

Covering's) favor were that its insulating value remains practically unchanged by moisture; that its durability, on account of its moisture-resisting qualities, is the highest, and that the labor required for application would be much less and need not be so skilled." To these reasons for its adoption may be added the fact that Nonpareil Cork Covering is neat and trim in appearance, and besides is slow-burning and not subject to spontaneous combustion.



Distributing Lines Insulated with Nonpareil Cork Covering
The Lunkenheimer Company, Cincinnati, Ohio

Nonpareil Cork Covering

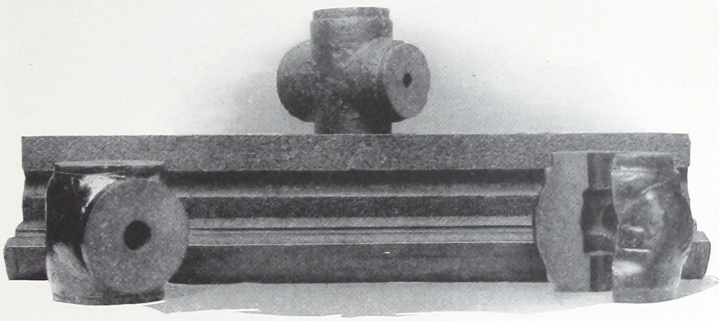
How Cork Covering is Made

Nonpareil Cork Covering is manufactured by compressing and then baking pure granulated cork in metal molds of the proper shape to fit the many different sizes of pipe and the various fittings in ordinary use. The baking process brings out the natural gum of the cork itself, binding the whole mass together firmly. No foreign binder is used for the

simple reason that none is necessary. The natural waterproof gum is far better than any artificial glue or cement. As the covering comes from the molds, it is coated inside and out with a waterproof mineral rubber finish. The covering, moreover, is applied with waterproof cement on the joints, rendering them impervious to moisture.

A Special Grade for Ice Water Lines

A special grade, known as Ice Water Covering, approximately 1½ inches thick, is manufactured for the insulation of refrigerated drinking water lines, heavier grades being supplied for brine and ammonia



Nonpareil Cork Covering

piping. Nonpareil Cork Lagging, beveled to any desired radius, is furnished for insulating cylindrical water coolers, filters, etc.

The Insulating Efficiency of Nonpareil Cork Covering

Why It is an Excellent Non-conductor

To a clear understanding of why Nonpareil Cork Covering is such an excellent non-conductor of heat, and, therefore, so well-suited for the insulation of ice water lines, it is necessary to explain what cork is and where it comes from:

Cork

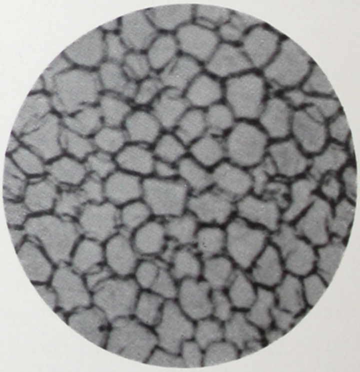
This peculiar substance is the outer bark of the cork oak, a tree that flourishes in the hot and semi-arid climate of the Spanish Peninsula and Northern

Stripping Cork Bark from Trees in Portugal

Africa. Sheathing trunk and branches, it prevents the sun's rays and the parching winds from heating and drying up the cool, life-giving sap that mounts upward through the inner bark—the real skin. When fire sweeps the forests, the cork oak alone survives, thanks to its protecting shield of bark. It is not surprising, therefore, to find that cork in its natural state is an excellent heat insulator.

The Cellular Structure of Cork

The reason becomes obvious when the bark is examined under the microscope. Its peculiar structure can then be clearly seen—myriads of minute air cells, separated from each other by thin walls of tissue. Each of these microscopic cells contains a bit of air,

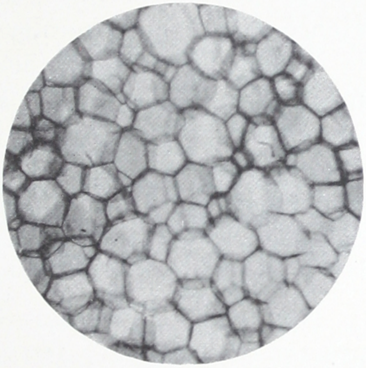


Cork Under the Microscope

and each one, moreover, is sealed up tight and rendered impervious to air and moisture. In other words, cork fulfills the one essential requirement for a good non-conductor of heat, viz: it contains a large amount of entrapped air absolutely confined in minute particles. "Dead air" is the best insulator known, a vacuum alone excepted.

Cells Not Destroyed by Manufacturing Process

Now the cellular structure of the natural cork is not injured by the process employed in making Non-pareil Cork Covering. This is proven by microscopic inspection of the finished product. The pressure to which the granulated cork is subjected goes principally to fill up the voids between the granules, while the baking process actually increases the insulating efficiency of the raw material in two ways: first, by driving off all sap, thus increasing the volume of confined air; second, by coating the surface of each separate granule with a thin film of the natural waterproof gum which affords an additional barrier against the entrance of moisture. Just compare the micro-photograph of Nonpareil Cork on this page with that of natural cork on the page preceding.



Nonpareil Cork Under the Microscope

The Insulating Efficiency of Cork Covering

It is, therefore, the peculiar cellular structure of cork, combined with the manufacturing process that gives Nonpareil Cork Covering its remarkable insulating efficiency. Exactly how efficient it is, is shown by the tables giving the heat transmission per lineal foot, on page 33 of this book.

The Durability of Nonpareil Cork Covering

The Ability to Resist Moisture

Insulating efficiency, however, is but the first requisite for satisfactory cold pipe covering. Durability in service, lasting quality that ensures long life without diminution of initial efficiency, is of even more importance. This translated into simplest terms means merely the ability to resist moisture, and it is in this respect that other types of cold pipe covering are found wanting.

Capillary Attraction

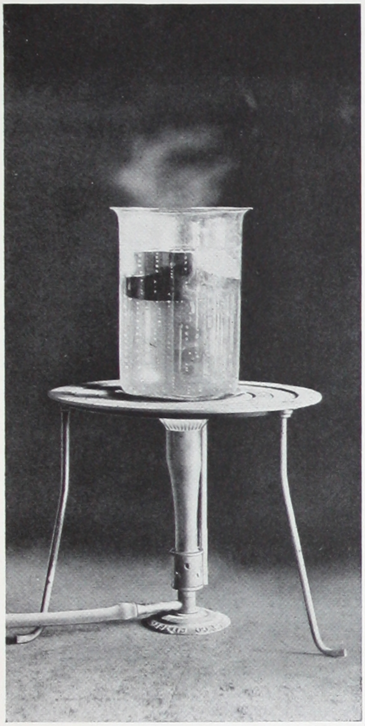
Coverings of felt or of fibrous character have marked capillary attraction—a tendency to suck in moisture. Furthermore, the air-spaces in coverings of this kind are not absolutely independent of each other, but are merely voids between the closely matted fibres. Hence while such coverings may be efficient when dry, it is difficult to keep them in that condition. No matter how carefully the attempt is made to waterproof them, sooner or later, moisture usually penetrates them, rendering them worthless as insulators and sometimes causing their disintegration. Repairs are expensive as such coverings generally consist of several layers, built up on the job.

Cork Covering is Moisture Proof

Nonpareil Cork Covering, on the other hand, possesses no capillary attraction. Its minute air cells are impenetrable to moisture. Each granule of cork composing it is coated with the natural waterproof gum by the manufacturing process. Its mineral rubber finish is a further protection against moisture. In applying it, all joints are sealed with Nonpareil Waterproof Cement. Hence the material keeps dry and maintains its original efficiency almost indefinitely. It will not rot and never gives off offensive odors.

A simple test which anyone can make will demonstrate conclusively that it will keep itself dry and efficient. Put a piece of Nonpareil Cork Covering into

boiling water. Weight it down until it is entirely submerged. Let it boil for two or three hours, then break it open and you will find the granules of cork dry inside. You will also be surprised to discover that the boiling has not expanded it appreciably in any direction. This severe test is designed simply to concentrate in a short time those destructive forces to which all forms of cold pipe insulation are subjected during their term of actual service. The same experiment on other coverings will yield interesting conclusions.



Boiling Test on Nonpareil Cork Covering

A Striking Test

As a matter of fact, no material yet devised can approach Nonpareil Cork Covering in durability. At Mills' Hotel No. 1, New York City, a considerable quantity of Cork Covering was removed from an old brine line in December, 1909, owing to the rusting out of the pipe from the inside. In the engineer's own words: "It really seemed too bad to remove the covering, it being in such good condition, notwithstanding its having been in use for *eleven and a half years*." All that could be taken off without being broken into too short lengths was used over again in insulating the new line. That this is not an exceptional case is evidenced by the fact that at the Continental Hotel,

The Remarkable Durability of Cork Covering

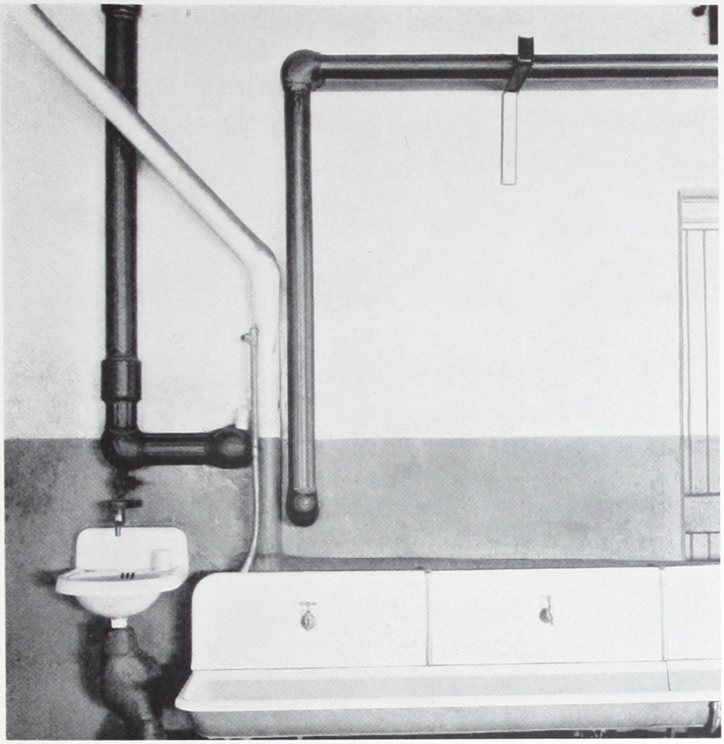
Philadelphia, in 1911, changes in the power plant necessitated the removal of a considerable quantity of Nonpareil Cork Covering, practically all of which was found to be in as good condition as when it was installed in 1900. In both these cases, the material was used on brine lines where the temperature conditions are far more severe than in the case of drinking water systems. On the latter, it is fair to say that Nonpareil Cork Covering will last indefinitely, provided it is properly applied and given reasonable care.

Section of Nonpareil Cork Covering from Mills' Hotel No. 1, New York City
A piece of the pipe may be seen imbedded in the covering

The Ease With Which Nonpareil Cork Covering May Be Applied

A Single-layer Sectional Jacket

The cost of any pipe covering depends, in large measure, on the expense of application. In this respect, Nonpareil Cork Covering has a decided advantage. Its structural strength, its sectional form (it is made in three-foot lengths) and its molded fitting covers render its application simple and rapid. It consists of a single jacket, applied with Nonpareil Waterproof Cement on all joints and wired securely in place with copper clad steel wire.



Nonpareil Cork Covering on Drinking Water Lines
John B. Stetson Company, Philadelphia, Pa.

Besides, Nonpareil Cork Covering requires no waterproofing on the job. It is coated at the factory with mineral rubber, inside and out. The only finish it needs after application is a coat of Nonpareil Asphaltic Paint. Canvas jackets are unnecessary. If a leak occurs at any point, the sections affected can be easily removed without disturbing the remainder of the covering, and repairs made at minimum expense and trouble. All the materials used in applying Nonpareil Cork Covering are supplied with the covering—without extra charge.

Repairs Easy to Make

The Neat Appearance of Nonpareil Cork Covering

Trim and Symmetrical

In appearance, a line covered with Nonpareil Cork Covering is neat and symmetrical. Molded cork jackets are supplied for all fittings smaller than eight inches. These are designed so as to follow the general contour of the fittings, thus preserving the symmetry of the lines. The trimness and neatness of a cork-covered line remains throughout its life and service. There is never bulging or swelling, as the material will not absorb moisture.

The Slow-Burning and Fire-Retarding Qualities of Nonpareil Cork Covering

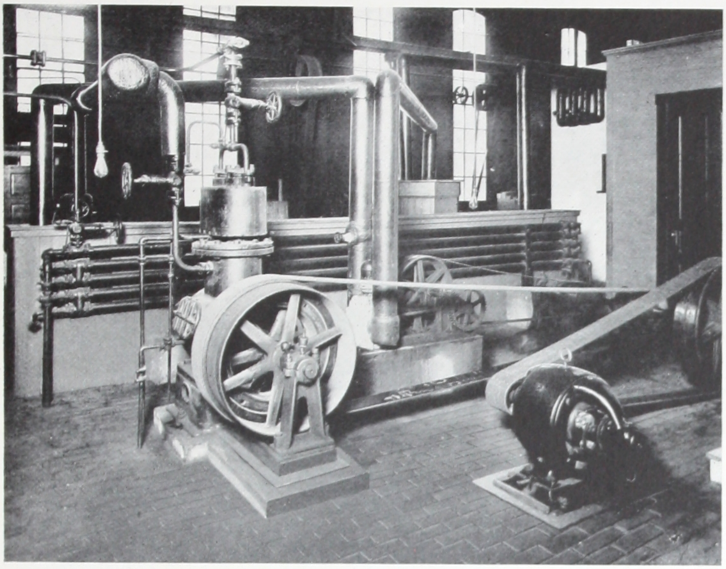
Not Subject to Spontaneous Combustion

Cork is a slow-burning and fire-retarding substance, since it will not support combustion in the absence of heat, applied from some external source. When flames impinge on its surface the outer layers are reduced to carbon, which remains sticking in position, and, being itself a good non-conductor of heat, protects the portion underneath from further damage. What is true of the raw material is also true of Nonpareil Cork Covering. It may be classed as a slow-burning and fire-retarding material, which is entirely free from any tendency toward spontaneous combustion. This is a feature which is of particular importance where drinking water lines pass through rooms or buildings where there are high temperatures, flying sparks, hot metal, etc.

Determination of the Insulating Efficiency of Nonpareil Cork Covering

Importance of such Data

The importance of determining the exact insulating value of Nonpareil Cork Covering and the heat absorption through cold pipe surfaces hardly requires explanation. Only with this information, is it possible to design, and insulate a drinking water system on a



Testing Plant—Refrigerating Machinery

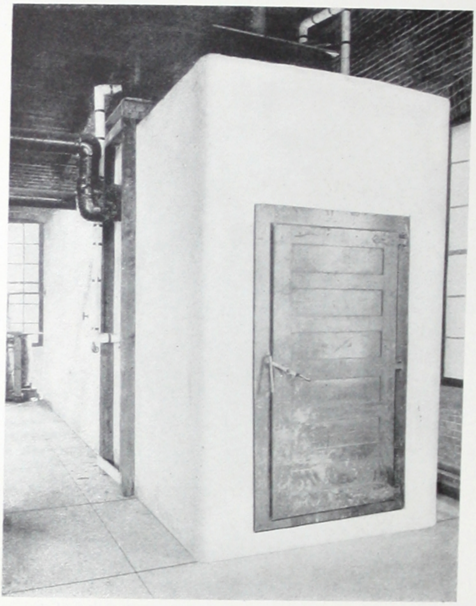
scientific basis. The amount of refrigeration required, the velocity necessary to maintain the required temperature, etc., are directly dependent on the insulation of the pipes.

The Testing Station

Despite its importance, little accurate information on this subject was available until a short time ago. Tests previously made by various investigators had in most cases been conducted on such a small scale, with such crude apparatus that the results were not to be relied on. Hence to obtain reliable data under conditions paralleling those existing in actual practice, the Armstrong Cork & Insulation Company found it necessary to install a pipe covering testing plant at Beaver Falls, Pa., some years ago. This testing station is unique in scope and equipment. It comprises a well-insulated room 6 feet wide, 26 feet long and 10 feet high—and a three-ton refrigerating machine.

The Test Apparatus

The testing apparatus itself consists of fifteen feet of eight-inch pipe, blanked off at each end with a cap and set up on wood supports inside the testing room. A half-inch hole in each cap serves as the cold brine inlet and outlet, respectively. The inlet is at the bottom of the pipe at one end and the outlet at the top of the pipe at the other end. One of the supports is higher than the other, so that the pipe slants upward toward the outlet, preventing air pockets forming as the cold brine is pumped through. When covering is tested, the entire fifteen feet of eight-inch pipe is covered with the material under test. In testing the loss from bare pipe, the pipe—needless to say—remains uncovered.

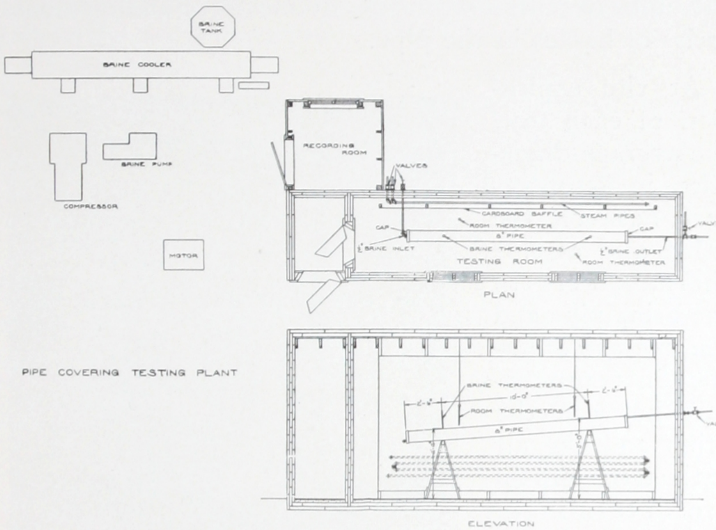


Pipe Covering Testing Room

The Instruments

Two calibrated thermometers, graduated to tenths of a degree, reading from—15° F. to 50° F. are set in the pipe ten feet apart—two and a half feet from each end so the bulb of each thermometer comes about at the center of the pipe. The thermometers are set at that distance from the ends of the pipe in order that it may be carried on supports outside of the portion under test, namely, the ten feet between the two thermometers. The temperature of the room, which is heated by a steam coil hung along one side, is indicated

by two Fahrenheit thermometers, one on either side of, and hanging about on a line with, the eight-inch pipe. A baffle plate, extending from six inches above the floor to within six inches of the ceiling, is placed in front of the coil to prevent direct radiation and to assure circulation and uniform temperature throughout.



PIPE COVERING TESTING PLANT

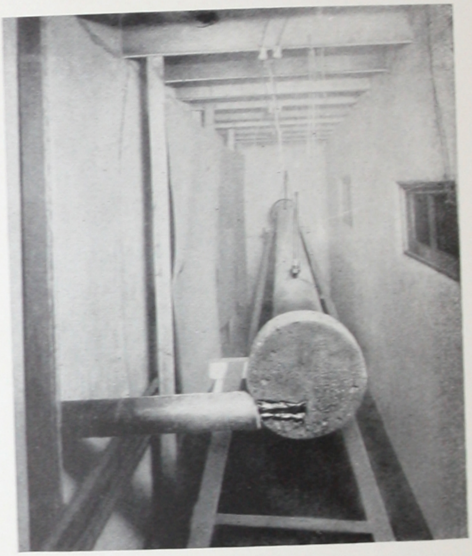
The procedure in making tests is as follows: The heating coil is turned on, the refrigerating machinery started, and cold brine pumped through the eight-inch pipe. After constant conditions are obtained, cold brine is continually circulated through the pipe and the room held at whatever temperature is decided on for twenty-four to forty-eight hours additional, before readings are taken. During the whole of each test, the temperature of the testing room is held constant and the temperature of the ingoing brine and the amount of flow kept as nearly uniform as possible. The two brine thermometers and the two room thermometers are read every fifteen minutes through windows in the

The Test Procedure

test room, and the brine flowing through the pipe, caught and weighed with great care. The brine outlet thermometer of course, gives a higher reading than the brine inlet thermometer, this difference being due to the heat which passes into the brine through the test area, namely, the ten feet of pipe between the two thermometers. The brine is brought in contact with the bulbs of both instruments by means of an ingenious series of baffles in the pipe.

The Test Data

At the expiration of each test, the average difference in temperature between the inlet and outlet thermometers in the brine pipe and the average difference in temperature between the brine and the air in the testing room are determined, and the number of pounds of brine flowing in twenty-four hours ascertained. If bare pipe is being tested, the surface area of the ten feet between the two thermometers must be determined; if covering, the area at the mean circumference. The specific heat of the brine, that is, the amount of heat necessary to raise one pound of brine one degree Fahrenheit, is obtained from tables giving such information.



Interior of Pipe Covering Testing Room

Determining the Results

From these data, the total absorption of heat (i. e., the amount of refrigeration lost) in twenty-four hours, through the ten feet of pipe between the thermometers, either bare or covered, as the case may be, is obtained

by multiplying the number of degrees rise in temperature of the brine in passing from one thermometer to the other, by the number of pounds of brine flowing in twenty-four hours, and then multiplying this product by the amount of heat required to raise one pound of brine one degree. This result divided by the area of the bare pipe in square feet, or by the area of the covering at the mean circumference, as the case may be, gives the amount of refrigeration lost per square foot in twenty-four hours. By again dividing, this time by the average difference in temperature between the air and the brine, there is obtained the absorption of heat through the bare pipe, or pipe covering, whichever is being tested, per square foot, per degree difference in temperature for twenty-four hours.

Expressing this as a formula may make the process of calculation clearer:

$$\left.\begin{array}{l}\text{The heat absorption (i. e., the loss of}\\ \text{refrigeration), in British Thermal Units, per square}\\ \text{foot, per degree difference in temperature for}\\ \text{twenty-four hours.}\end{array}\right\} = \frac{A x B x C}{D x E}$$

where *A* is the number of degrees rise in temperature of the brine in passing from one thermometer to the other in the pipe;

The Test Formula

B is the number of pounds of brine flowing through the pipe in twenty-four hours;

C is the specific heat of the brine, or, in other words, the quantity of heat, measured in *British Thermal Units, required to raise one pound of the brine one degree Fahrenheit;

D is the number of degrees average difference in temperature between the air outside and the brine inside, and

E is the area in square feet at the mean circumference of the ten feet of covering between the two thermometers, or the surface area of the ten feet of bare pipe, whichever is under test.

Typical Logs

Typical logs of tests on bare pipe and on Nonpareil Cork Covering—Ice Water thickness—are given on the following pages. The thermometers used were of the most delicate type and every precaution was taken to secure accurate results.

*A British Thermal Unit, or "B. T. U." is the amount of heat required to raise a pound of water at maximum density one degree Fahrenheit.

Eight-Inch Nonpareil Cork Covering

Standard Ice Water Thickness

TEST No. 1 **December 8, 1909**

Time	Temperature of Brine		Temperature of Room	
	Therm. No. 1 Deg. F.	Therm. No. 2 Deg. F.	Therm. No. 1 Deg. F.	Therm. No. 2 Deg. F.
9:30	29.5	35.9	162.75	163.5
9:45	30.3	36.00	162.75	163.5
10:00	30.0	35.9	163.00	163.75
10:15	29.8	35.6	163.00	163.75
10:30	29.2	35.6	163.00	163.75
10:45	29.1	35.7	163.00	163.75
11:00	30.2	35.6	163.00	163.75
11:15	30.4	35.4	163.00	163.75
11:30	29.6	35.1	163.00	163.75
11:45	29.4	35.1	163.25	164.00
12:00	30.3	35.2	163.25	164.00
12:15	30.8	35.1	163.25	164.00
12:30	30.5	35.1	163.50	164.25
12:45	30.1	35.2	163.50	164.25
1:00	29.6	35.0	163.50	164.25
1:15	28.9	35.1	163.50	164.25
1:30	29.9	35.2	163.75	164.50
1:45	30.3	35.1	163.75	164.50
2:00	30.7	34.6	164.00	164.75
2:15	30.5	34.4	160.00	160.75
2:30	30.1	34.3	159.00	159.75
2:45	30.9	34.5	158.5	159.25
3:00	30.7	34.6	158.5	159.25
3:15	30.0	34.7	158.25	159.00
3:30	29.4	34.9	158.5	159.25
3:45	29.1	35.00	158.5	159.25
4:00	29.9	34.8	158.5	159.25
4:15	30.5	34.5	158.75	159.50
4:30	30.4	34.4	158.5	159.25
4:45	30.5	34.1	158.5	159.25
5:00	30.2	34.2	158.75	159.50
Average	30.0	35 0	161.5	162.2
Mean Average	32.5		161.85	

Weight of brine from 9:30 a. m. to 5:00 p. m. 1146.75 pounds
Weight of brine flowing at the above rate for 24 hours 3669.6 pounds
Average difference between thermometers in brine 5 degrees F.
Average difference between temperature of brine and room 129.35 degrees F.
Area of pipe covering at mean circumference 28.14 sq. feet
Specific heat of brine .8
Thickness of pipe covering 2.12 inches

$$\frac{3669.6 \times 5 \times .8}{28.14 \times 129.35} = 4.03$$ B. T. U. per square foot at mean circumference of covering per degree difference in temperature for twenty-four hours.

$$\frac{3669.6 \times 5 \times .8 \times 2.12}{28.14 \times 129.35} = 8.55$$ B. T. U. per square foot at mean circumference of covering per one-inch thickness per degree difference in temperature for twenty-four hours.

Eight-Inch Cast-Iron Pipe

TEST No. 1 **December 15, 1909**

Time	Temperature of Brine		Temperature of Room	
	Therm. No. 1 Deg. F.	Therm. No. 2 Deg. F.	Therm. No. 1 Deg. F.	Therm. No. 2 Deg. F.
9:00	31.4	47.8	139.00	139.75
9:15	30.0	48.3	138.50	139.25
9:30	30.5	48.5	138.50	139.25
9:45	30.5	48.4	138.75	139.50
10:00	31.9	48.5	138.50	139.25
10:15	34.3	49.3	137.75	138.50
10:30	33.6	49.8	138.00	138.75
10:45	32.7	50.0	138.00	138.75
11:00	32.0	50.2	138.00	138.75
11:15	31.5	50.2	138.00	138.75
11:30	31.4	50.1	137.75	138.50
11:45	31.6	49.8	137.75	138.50
12:00	30.4	48.6	137.25	138.00
12:15	30.6	48.4	137.25	138.00
12:30	31.2	48.6	137.25	138.00
12:45	30.6	48.7	137.25	138.00
1:00	31.3	48.9	137.25	138.00
1:15	31.6	49.1	137.25	138.00
1:30	31.8	49.3	137.25	138.00
1:45	32.8	49.9	137.25	138.00
2:00	31.8	50.0	137.25	138.00
2:15	32.0	50.2	137.25	138.00
2:30	31.3	50.1	137.25	138.00
2:45	30.7	49.6	137.25	138.00
3:00	30.4	49.1	137.25	138.00
3:15	30.4	48.6	137.00	137.75
3:30	31.5	48.7	137.00	137.75
3:45	31.2	48.6	136.75	137.50
4:00	31.1	48.8	136.50	137.25
4:15	30.7	48.3	136.50	137.25
4:30	31.1	47.8	136.25	137.00
4:45	31.8	47.8	136.25	137.00
5:00	31.8	48.2	136.50	137.25
Average	31.44	49.00	137.44	138.19
Mean Average	40.22		137.82	

Weight of brine from 9:00 a. m. to 5:00 p. m. .... 2257.25 pounds

Weight of brine flowing at the above rate for 24 hours .... 6771.75 pounds

Average difference between thermometers in brine .... 17.56 degrees F.

Average difference between temperature of brine and room ... 97.6 degrees F.

Surface area of pipe .... 22.57 square feet

Specific heat of brine 8

$$\frac{6771.75 \times 17.56 \times .8}{22.57 \times 97.6}$$ = 43.18 B. T. U. per square foot of pipe surface per degree difference in temperature for twenty-four hours.

Summary of Tests

A series of tests conducted in this manner indicate that the heat transmission through Nonpareil Cork Covering per square foot *at the mean circumference* per one-inch thickness per degree difference in temperature for twenty-four hours is 8.6 B. T. U.; and that the heat absorption through bare pipe is 43.2 B. T. U. per square foot of pipe surface per degree difference in temperature for twenty-four hours. With these unit transmissions as a basis, it is a simple matter of calculation to determine the transmission per lineal foot per degree difference in temperature for twenty-four hours through the several sizes of Nonpareil Cork Covering—Ice Water thickness and Brine thickness—and also through bare pipe of the various sizes in common use. These data are given in the tables which follow:

The Transmission per Lineal Foot

Drinking Fountain at Blacksmith's Forge, National Tube Company, Pittsburgh, Pa. All Ice Water Lines in this Plant are Insulated with Nonpareil Cork Covering

Table No. 1—Ice Water Thickness

Pipe Size Inches	Transmission in British Thermal Units per *lineal* foot, per degree difference in twenty-four hours	Pipe Size Inches	Transmission in British Thermal Units per *lineal* foot, per degree difference in twenty-four hours
½	3.84	4½	9.20
¾	4.00	5	9.84
1	4.26	6	10.49
1¼	4.78	7	12.05
1½	5.27	8	11.41
2	5.88	9	14.62
2½	6.98	10	14.79
3	7.30	12	19.98
3½	7.82	14	21.71
4	8.29	16	24.50

Table No. 2—Standard Brine Thickness

½	3.37	4½	5.93
¾	3.53	5	6.75
1	3.73	6	7.03
1¼	3.87	7	8.49
1½	3.96	8	8.72
2	4.44	9	9.04
2½	4.84	10	10.01
3	5.20	12	11.46
3½	5.46	14	12.36
4	6.21	16	13.80

Table No. 3—Bare Pipe

½	9.50	4½	56.55
¾	11.88	5	62.88
1	14.81	6	74.87
1¼	18.77	7	86.18
1½	21.49	8	97.49
2	26.80	9	108.80
2½	32.46	10	121.56
3	39.58	12	144.20
3½	45.24	14	158.34
4	50.89	16	180.96

With the data given in Table No. 1, it is an easy matter to determine how much refrigeration would be required to take care of the heat absorbed by the drinking water in passing through the distributing lines. Simply multiply the number of lineal feet of pipe by the transmission factor for that size of pipe, and then multiply the product by the number of degrees Fahrenheit difference between the average temperature of the water in the pipe and the average temperature of the air outside. The result will be the total heat absorbed through the covered line per day, expressed in British Thermal Units. Divide by 284,000, the number of B. T. U. in a ton of refrigeration, and you will have the number of tons of refrigeration that will be required per day to take care of the heat absorbed through the distributing lines.

Using the Test Data

By consulting Table No. 3 and following a similar process of calculation, you can determine what the absorption would be through the bare pipe and then by subtracting, show exactly what the covering is saving in tons of refrigeration per day. While this saving is important, the real mission of the covering, of course, is to keep the temperature uniform. What an important part the insulation of the distributing lines plays in the designing of a drinking water system, is made clear in the following section:

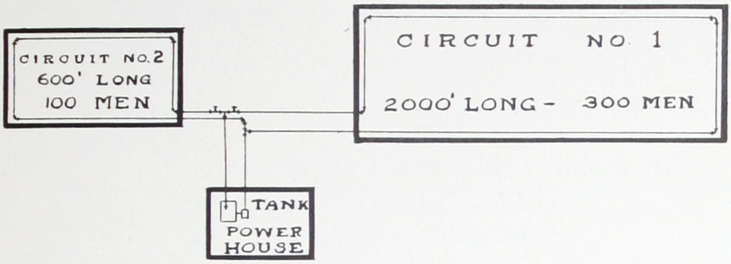
The Saving Effected by the Covering

Designing a Typical Drinking Water System

A Concrete Example

Let us assume that we have two buildings for which it is necessary to have one circuit 2000 feet long to supply 300 men, and one circuit 600 feet long to supply 100 men, with a supply main from the tank to the branches approximately 100 feet long. The water is

to have a temperature of 45° at the supply end of each circuit and is to have a maximum temperature rise of 5° F. The average temperature of the mill is taken as 95° F. The difference in temperature between the



A Typical Drinking Water System

water and air is, therefore, 50° F. The quantity of water required per man per hour is 0.25 gallons.

Circuit No. 1

Assume that a one-inch line will be needed.

Length of line	2000 feet
Number of men working	300

The quantity of water required for ten hours $= 300 \text{x} .25 \text{x} 10 =$ 750 gallons.

The absorption of heat through Nonpareil Cork Covering (Ice Water thickness) for one-inch pipe $= 4.26$ B. T. U. per 24 hours, per 1° difference in temperature, per lineal foot of covering. (See Table No. 1 on page 33.)

The heat absorption per 10 hours $= 2000 \text{x} \frac{4.26}{24} \text{x} 50 \text{x} 10 = 177{,}500$ B. T. U.

To raise one pound of water 5° will require 5 B. T. U.

The number of pounds of water per 10 hours necessary to insure a temperature rise of only $5° = \frac{177{,}500}{5} = 35{,}500$ pounds.

35,500 pounds $= \frac{35{,}500}{8.3} = 4277$ gallons per 10 hours.

4277 gallons+750 gallons (water used and wasted) = 5027 gallons.

It would be necessary then to pump: $\frac{5027}{10x60} = 8.38$ gallons = 1.12 cubic feet per minute.

Inside cross sectional area of one-inch pipe = .006 square feet.

Velocity then at the supply end of the circuit would be $\left\{V = \frac{Q}{A}\right\} \frac{1.12}{.006} = 186.7$ feet per minute.

Circuit No. 2

Assume that a one-inch line will be needed.

Length of line	600 feet
Number of men working	100

Quantity of water required per 10 hours = 100x.25x10 = 250 gallons.

Heat absorption per 10 hours = $600x\frac{4.26}{24}x50x10 = 53{,}250$ B. T. U.

The number of pounds of water per 10 hours necessary to insure a temperature rise of $5° = \frac{53{,}250}{5} = 10{,}650$ pounds.

$\frac{10{,}650}{8.3} = 1283$ gallons per 10 hours.

1283 gallons + 250 gallons (used and wasted) = 1533 gallons per 10 hours.

It would be necessary then to pump: $\frac{1533}{10x60} = 2.555$ gallons = .341 cubic feet per minute.

Inside cross sectional area of one-inch pipe = .006 square feet.

Velocity then at the supply end of the circuit would be $\left\{V = \frac{Q}{A}\right\} \frac{.341}{.006} = 57$ feet per minute.

Main Circuit

A 1¼-inch line will be necessary to supply the two one-inch branch lines.

Length of supply line is 100 feet.

Quantity of water per minute = 1.12+.341 = 1.461 cubic feet per minute.

Inside cross sectional area of $1\frac{1}{4}$-inch pipe = .0104 square feet.

Velocity $\left\{\frac{Q}{A}\right\} = \frac{1.461}{.0104} = 140.4$ feet per minute.

Heat absorbed per 10 hours on main supply $= 100\text{x}\frac{4.78}{24}\text{x}50\text{x}10$ $= 9959$ B. T. U.

Quantity of supply water per 10 hours = 54,448 pounds.

$\frac{9959}{54,448} = .18°$ loss in main supply line.

Therefore, the temperature of the water at the tanks would have to be 44.82°.

Heat absorbed per 10 hours on main return $= 100\text{x}\frac{4.78}{24}\text{x}45\text{x}10$ $= 8962$ B. T. U.

Quantity of return water per 10 hours = 46,150 pounds.

$\frac{8962}{46,150} = .19°$ loss in main return line.

Therefore, the temperature of the return water at the end of the return main should be 50.19°.

Refrigeration Required

Assume the temperature of the supply water to be 75°. The amount of water used and wasted *per hour* equals 830 pounds. This amount of water will have to be drawn from the source of supply each hour. It would be necessary then to use sufficient refrigeration to cool this water to 44.82°.

830x30.18 = 25049.4 B. T. U. = Heat that must be removed from supply water per hour.

In addition to this, it would be necessary to cool the return water from 50.19° to 44.82° = 5.37°.

Return water *per hour* = 4615 pounds.

4615x5.37 = 24782.6 B. T. U. = Heat that must be removed from return water per hour.

One ton of refrigeration = 284,000 B. T. U.

Refrigeration necessary $= \frac{(25049.4 + 24782.6)}{284,000}\text{x}24 = 4.21$ tons per 24 hours.

This, however, does not include the refrigeration which is necessary to overcome the losses through the water tank, pumps, etc.

Installations

Among the installations of Nonpareil Cork Covering on drinking water lines are the following:

Industrial Establishments

Hegeler Brothers	Danville, Ill.
Commonwealth Steel Co.	Granite City, Ill.
Mississippi River Power Co.	Keokuk, Iowa
Courier Journal Printing Co.	Louisville, Ky.
H. D. Foss Co.	Boston, Mass.
Geo. Close Co.	Cambridge, Mass.
Bigelow Carpet Co.	Clinton, Mass.
Farr Alpaca Mill	Holyoke, Mass.
Edison Illuminating Co.	Detroit, Mich.
Ford Motor Company	Detroit, Mich.
Regan Brothers, Bakers	Minneapolis, Minn.
Busy Bee Candy Co.	St. Louis, Mo.
Nashua Manufacturing Co.	Nashua, N. H.
Keystone Watch Case Co.	Riverside, N. J.
Consolidated Gas Co.	New York City, N. Y.
New York Edison Co.	New York City, N. Y.
New York Telephone Co.	New York City, N. Y.
The Biograph Co.	New York City, N. Y.
United Electric Light & Power Co.	New York City, N. Y.
Western Electric Co.	New York City, N. Y.
Eastman Kodak Co., (Premo Division)	Rochester, N. Y.
German-American Button Co.	Rochester, N. Y.
Taylor Instrument Companies	Rochester, N. Y.
Yawman & Erbe Manufacturing Co.	Rochester, N. Y.
Goodyear Tire & Rubber Co.	Akron, Ohio
The Lunkenheimer Co.	Cincinnati, Ohio
Upson Nut Co.	Cleveland, Ohio
G. Edwin Smith Shoe Co.	Columbus, Ohio
Carnegie Steel Co., Edgar Thompson Works	Bessemer, Pa.
Flannery Bolt Co.	Bridgeville, Pa.
Westinghouse Electric & Mfg. Co.	East Pittsburgh, Pa.
Carnegie Steel Co.	Farrell, Pa.
Carnegie Steel Co.	Homestead, Pa.
Aluminum Company of America	New Kensington, Pa.
Breyer Ice Cream Co.	Philadelphia, Pa.
Curtis Publishing Co.	Philadelphia, Pa.
J. B. Stetson Co.	Philadelphia, Pa.
Macbeth-Evans Glass Co.	Pittsburgh, Pa.
National Tube Co., Continental Works	Pittsburgh, Pa.
National Tube Co., Pennsylvania Works	Pittsburgh, Pa.
Westinghouse Air Brake Co.	Wilmerding, Pa.

Office Buildings

Bell Building - - - - - - - - - - - -	Montgomery, Ala.
Candler Building - - - - - - - - - - -	Atlanta, Ga.
Healey Building - - - - - - - - - - -	Atlanta, Ga.
Third National Bank Building - - - - - - -	Atlanta, Ga.
C. B. & Q. Building - - - - - - - - - -	Chicago, Ill.
Chicago Telephone Building - - - - - - -	Chicago, Ill.
Harris Trust Building - - - - - - - - -	Chicago, Ill.
Stevens' Building - - - - - - - - - -	Chicago, Ill.
Fletcher Savings & Trust Co. Building - - - -	Indianapolis, Ind.
Santa Fe Office Building - - - - - - - -	Topeka, Kan.
Beacon Building - - - - - - - - - - -	Wichita, Kan.
Schweiter Building - - - - - - - - - -	Wichita, Kan.
Fayette Bank Building - - - - - - - -	Lexington, Ky.
Starke Building - - - - - - - - - - -	Louisville, Ky.
Oliver Building - - - - - - - - - - -	Boston, Mass.
The Henry Smith Building - - - - - - -	Detroit, Mich.
Bell Telephone Building - - - - - - - -	Kansas City, Mo.
Grand Avenue Temple - - - - - - - -	Kansas City, Mo.
Montgomery Ward & Co. - - - - - - - -	Kansas City, Mo.
Rialto Building - - - - - - - - - - -	Kansas City, Mo.
Republic Bank Building - - - - - - - -	Kansas City, Mo.
Syndicate Trust Building - - - - - - - -	St. Louis, Mo.
Commercial Trust Co. - - - - - - -	Jersey City, N. J.
Prudential Building - - - - - - - - - -	Newark, N. J.
Barclay Building - - - - - - - - - - -	New York City, N. Y.
Chemical National Bank Building - - - - - -	New York City, N. Y.
Fifth Avenue Building - - - - - - - -	New York City, N. Y.
Hudson Terminal Building - - - - - - -	New York City, N. Y.
Masonic Temple - - - - - - - - - - -	New York City, N. Y.
Park National Bank Building - - - - - - -	New York City, N. Y.
Physicians' Building - - - - - - - - -	New York City, N. Y.
Singer Building - - - - - - - - - - -	New York City, N. Y.
Washington Life Building - - - - - - - -	New York City, N. Y.
Cutler Building - - - - - - - - - - -	Rochester, N. Y.
Granite Building - - - - - - - - - - -	Rochester, N. Y.
Powers Building - - - - - - - - - - -	Rochester, N. Y.
Bell Telephone Building - - - - - - - -	Cincinnati, Ohio
Mercantile Library Co. - - - - - - - -	Cincinnati, Ohio
Union Central Life Insurance Building - - - -	Cincinnati, Ohio
Swetland Building - - - - - - - - - -	Cleveland, Ohio
Farm Journal Building - - - - - - - -	Philadelphia, Pa.
North American Building - - - - - - - -	Philadelphia, Pa.
Henry W. Oliver Building - - - - - - - -	Pittsburgh, Pa.
Union Bank Building - - - - - - - - -	Pittsburgh, Pa.
Busch Building - - - - - - - - - - -	Dallas, Texas
First National Bank Building - - - - - - -	Galveston, Texas
Smith Building - - - - - - - - - - -	Seattle, Wash.
Canadian Pacific Building - - - - - - - -	Toronto, Ont.
Royal Bank Building - - - - - - - - -	Toronto, Ont.
Traders Bank Building - - - - - - - -	Toronto, Ont.

Hotels, Apartment Houses, Clubs, etc.

Ridgeley Apartments	Birmingham, Ala.
Tutwiler Hotel	Birmingham, Ala.
Rosslyn Hotel	Los Angeles, Cal.
Shay's Cafeteria	Los Angeles, Cal.
Stowell Hotel	Los Angeles, Cal.
New Southern Hotel	Chicago, Ill.
St. Nicholas Hotel	Springfield, Ill.
Claypool Hotel	Indianapolis, Ind.
Severin Hotel	Indianapolis, Ind.
Post Tavern	Battle Creek, Mich.
Addison Apartments	Detroit, Mich.
Hotel Pontchartrain	Detroit, Mich.
Pantlind Hotel	Grand Rapids, Mich.
Dyckman Hotel	Minneapolis, Minn.
Radisson Hotel	Minneapolis, Minn.
Lincoln Hotel	Lincoln, Neb.
Marlborough-Blenheim Hotel	Atlantic City, N. J.
Hotel Statler	Buffalo, N. Y.
Hotel Biltmore	New York City, N. Y.
Hotel McAlpin	New York City, N. Y.
R. T. Ford Apartments	Rochester, N. Y.
Nathan Harris Apartments	Rochester, N. Y.
Stanwood Apartments	Rochester, N. Y.
Wilsonia Apartments	Rochester, N. Y.
Onondaga Hotel	Syracuse, N. Y.
Business Men's Club	Cincinnati, Ohio
Gibson Hotel	Cincinnati, Ohio
Hotel Statler	Cleveland, Ohio
Otts Restaurant	Cleveland, Ohio
Severs Hotel	Muskogee, Okla.
Hotel Skirvin	Oklahoma City, Okla
Adelphia Hotel	Philadelphia, Pa.
Bellevue-Stratford Hotel	Philadelphia, Pa.
Manufacturers' Club	Philadelphia, Pa.
Rittenhouse Apartments	Philadelphia, Pa.
Davenport Hotel	Spokane, Wash.
Place Viger Hotel	Montreal, Que.

Public Buildings

Bureau of Engraving & Printing	Washington, D. C.
United States Court House	Baltimore, Md.
United States Post Office	Baltimore, Md.
Northampton Post Office	Northampton, Mass.
United States Post Office	Minneapolis, Minn.
Hudson County Court House	Jersey City, N. J.
United States Post Office	Jersey City, N. J.
Bronx County Court House	New York City, N. Y.
Hall of Records	New York City, N. Y.
Municipal Building	New York City, N. Y.
Public Library	New York City, N. Y.
Cuyahoga County Court House	Cleveland, Ohio

Hospitals

Cook County Hospital	Chicago, Ill.
Presbyterian Hospital	Chicago, Ill.
St. Francis Hospital	Topeka, Kan.
Johns-Hopkins Hospital	Baltimore, Md.
Forsyth Dental Infirmary	Brookline, Mass.
German Hospital	Kansas City, Mo.
Bellevue Hospital	New York City, N. Y.
Mt. Sinai Hospital	New York City, N. Y.
Wellsley Hospital	Toronto, Ont.
Providence Hospital	Seattle, Wash.

Stores

Baltimore Bargain House	Baltimore, Md.
Abraham & Strauss	Brooklyn, N. Y.
Bonwit Teller Building	New York City, N. Y.
Gimbel Brothers	New York City, N. Y.
R. H. Macy & Co.	New York City, N. Y.
John Wanamaker	New York City, N. Y.
Sibley, Lindsay & Curr Co.	Rochester, N. Y.
S. S. Kresge 5 and 10 cent Store	Cleveland, Ohio
The Stearns Co.	Cleveland, Ohio
The Sterling & Welch Co.	Cleveland, Ohio
Wm. Taylor, Son & Co.	Cleveland, Ohio
The Strauss-Hirshberg Co.	Youngstown, Ohio
Gimbel Brothers	Philadelphia, Pa.
N. Snellenburg & Co.	Philadelphia, Pa.
Strawbridge & Clothier	Philadelphia, Pa.
John Wanamaker	Philadelphia, Pa.
Butler Brothers	Dallas, Texas

Railroad Stations

Union Station	Washington, D. C.
Union Station	Baltimore, Md.
Union Station	Kansas City, Mo.
Grand Central Station	New York City, N. Y.
Broad Street Station	Philadelphia, Pa.
G. C. & S. F. Station	Galveston, Texas
Windsor Street Station	Montreal, Que.

Miscellaneous

Trinity Auditorium	Los Angeles, Cal.
Hamilton College	Lexington, Ky.
Hispanic Society	New York City, N. Y.
Masonic Home	Elizabethtown, Pa.
Rice Institute	Houston, Texas

Specifications for the Insulation of Ice Water Lines with Nonpareil Cork Covering

For the convenience of engineers and architects there is given below complete specifications for the insulation of drinking water systems with Nonpareil Cork Covering:

General Provisions

After the ice water lines have been tested and made tight, they shall be covered with Nonpareil Cork Covering—Ice Water thickness (approximately one and a half inches thick), having a mineral rubber finish. All foreign material, such as plaster, shall be removed from the surface of the pipe and also from the inside of the covering before it is applied.

Pipe Lines

All pipe lines shall be covered with Nonpareil Cork Sectional Covering. (Fig. 1.) All end joints shall be broken by making one-half of the first section eighteen inches long, leaving the other half thirty-six inches in length. All longitudinal joints shall be on the top and bottom of the pipe and not on the sides. The covering shall be applied with Nonpareil Waterproof Cement on all joints and wired in place with copper clad steel wire, using not less than six wires to a section.

Fig. 1

Fittings

All fittings shall be covered with molded Nonpareil Cork fitting covers, applied with Nonpareil Waterproof Cement on all joints, and wired in place with copper clad steel wire, using not less than four wires to a fitting. (Fig. 2.) All spaces between the covers and the fittings shall be filled with Nonpareil Brine Putty.

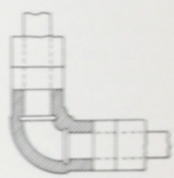


Fig. 2

Finishing

After the covering is applied, all seams and chipped edges shall be filled with Nonpareil Seam Filler so as to leave a smooth, even surface. The whole shall be given one good coat of Nonpareil Asphaltic Paint, or finished as directed.

Spacing

On all parallel lines there shall not be less than six inches between pipes, and not less than four inches between pipes and adjacent surfaces.

Hangers

All ice water lines shall be carried on hangers on the outside of the covering, which shall be protected by a sheet-iron shield between the hanger and the covering. (Fig. 3.) This shield shall extend four inches on each side of the hanger and shall be shaped to fit the covering, extending up the sides to the center line of the pipe.

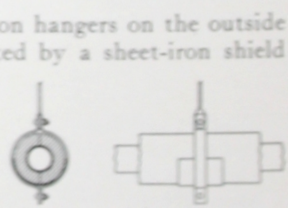


Fig. 3

Specifications for the Insulation of Cylindrical Ice Water Tanks with Nonpareil Cork Lagging

After the ice water tank has been tested and made tight, its cylindrical surface shall be insulated with one layer of three-inch Nonpareil Cork Lagging, weighing not less than 1.25 pounds per board foot. The lagging shall be beveled to the proper radius and shall have a mineral rubber finish on both the inner and outer surfaces, which finish shall be ironed on at the factory.

Cylindrical Surface

The lags shall be applied with Nonpareil Waterproof Cement on all joints and secured in place with one-inch bands of twenty-gauge iron, drawn up tight by means of bolts and clips riveted to the ends of the bands. (Fig. 4.) The bands shall be spaced not more than twelve inches apart. The transverse joints between the lags shall be broken. All spaces between the tank and the lagging shall be filled with Nonpareil Brine Putty.

Bands

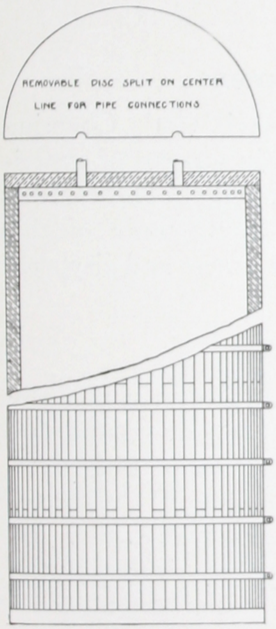


Fig. 4

The bottom of the tank shall be insulated with a disc of Nonpareil Cork Lagging three inches in thickness, cemented together with Nonpareil Waterproof Cement. The top is to be insulated with a similar disc, divided into two semi-circular pieces, and drilled for pipe connections along the center line. Both the top and bottom discs shall have a mineral rubber finish on the inner and outer surfaces, which finish shall be ironed on at the factory.

Top and Bottom

All seams and chipped edges shall be filled with Nonpareil Seam Filler so as to leave a smooth, even surface. The whole shall be given one good coat of Nonpareil Asphaltic Paint.

Finish

Note. If a square tank is used, specify eight inches of Unscreened Granulated Cork tamped around the sides, two courses of two-inch Nonpareil Corkboard Insulation laid in asphalt for the bottom, and two courses of two-inch Nonpareil Corkboard between T. and G. boards for the top.

Engineering Service

Free Co-operation

Through years of experience in this field, we have accumulated a mass of data which is at the disposal of all interested in the installation of refrigerated drinking water systems. Our engineering staff will be glad to co-operate with architects, engineers and plant owners in designing systems of this character. This service will be rendered without charge or implied obligation. Branch offices or direct representatives are located in the principal cities of the United States and Canada.

Contract Department

Installing Cork Covering

For the installation of Nonpareil Cork Covering and our other products, we maintain a corps of experienced erecting superintendents throughout the country and are therefore prepared to execute work of this character, however large, with promptness and dispatch.

Factory Facilities

Ample Output

Nonpareil Cork Covering is manufactured at Camden, N. J. The plant covers six acres of ground and is devoted exclusively to the production of this covering and its kindred product—Nonpareil Corkboard Insulation for cold storage plants, ice plants, etc. Its capacity is ample to handle orders of any size promptly. A large supply of all standard sizes and grades of covering and fittings is carried constantly in stock.

Samples and Estimates

Other Insulation Products

Samples, estimates and further information will be cheerfully supplied on request. Particular attention is directed to our other heat insulating materials listed with our products on the following page.

The Armstrong Line

Corks of every description

Washers and Gaskets

Bungs and Taps

Insoles

Handles

Bath and Table Mats

Life Preservers

Buoys

Yacht Fenders

Armstrong's Linoleum—plain, printed and inlaid

Nonpareil Cork Floor Tiling—for libraries, museums, billiard rooms, bath rooms, etc.

Armstrong's Linotile—for flooring offices, banks, theatres, kitchens, pantries, elevators, etc.

Cork Paving Brick—for stables, shipping platforms, warehouses, etc.

Nonpareil, Acme and Eureka Corkboard—for insulating cold storage rooms

Nonpareil Cork Covering—for cold pipes

Nonpareil High Pressure Covering—for steam lines, boilers, etc.

Nonpareil Insulating Brick—for boiler settings, furnaces, retorts, ovens, etc.

Machinery Isolation—for deadening the noise of fans, pumps and motors

Granulated Cork

Cork Specialties of every description

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